United States Naval Academy
Mechanical Engineering Department

EM324 Fluid Mechanics

Catalog Description: EM324 Fluid Mechanics **Credit:** 4 (3-2-4)
An introductory course in fluid dynamics stressing both the integral and differential forms of the conservation laws of fluid flow. Engineering applications are made to hydrostatics and to ideal and real fluid flows. Laboratory experiments and problems sessions complement the lectures.
Prerequisites: SM212
Corequisites: EM319 or equivalent.

Textbooks: A Brief Intro. to Fluid Mechanics by Young, Munson and Okiishi; John Wiley & Sons, 1st Edition (1997).
Supplemental Textbooks:
(1) Student Solutions Manual for Fundamentals of Fluid Mechanics, by Munson, Young and Okiishi; John Wiley & Sons, 3rd Edition (1998).
(2) Schaum's Outline Series Theory and Problems of Fluid Dynamics.
(3) Schaum's Solved Problems Series 2500 Solved Problems in Fluid Mechanics and Hydraulics.
(4) FE Review Manual, by Lindeburg, Professional Publications, (2000).

Course Director: Prof. Karen A. Flack

Objectives[1]:

1. To teach students the fundamentals of fluid properties, fluid statics and fluid dynamics with applications to a broad range of problems.[a,b]
2. To teach students the fundamentals of fluid topics related to naval applications .[a,b,c]
3. To demonstrate fluid phenomena through experimentation and design, and the methods of experimental dimensional analysis.[a,b]
4. To teach students the mathematical tools necessary to solve complex fluids problems.[a,c]
5. To develop students technical presentation skills through written and oral lab reports.
6. To develop students team problem solving skill through design and projects, problem sessions and laboratory exercises.[c,d]

Course Content:

No.	Topic or Subtopic	hrs.
1.	Mathematics	4
2.	Fluid Properties	4
3.	Hydrostatics, Hydraulics	7
4.	Buoyancy and Stability	1
5.	Fluid Kinematics	3
6.	Bernoulli Equation	6
7.	Integral Conservation Equations, Mass and Momentum	5
8.	Viscous Flow, Navier-Stokes Equations	5
9.	Potential flow	3
10.	Dimensional Analysis	5

11.	Pipe Flow	8
12.	Boundary Layers	2
13.	Lift and Drag	3
14.	Turbomachinery	6
15.	Open channel flow	3

Evaluation:

1. Quizzes	_x__ Yes	___ No
2. Homework	_x__ Yes	___ No
3. Exams	_x__ Yes	___ No
4. Laboratory Reports	_x__ Yes	___ No
5. Oral Presentations	_x__ Yes	___ No
6. Design Reports/Notebooks	_x__ Yes	___ No
7. Prototypes/Demonstrations	___ Yes	_x__ No
8. Projects	___ Yes	_x__ No
9. Any other evaluation tools used	___ Yes	_x__ No

Acquired Abilities[2]:

1.1 Students will demonstrate an understanding of fluid properties including the measurement of the property and its dependence on pressure and temperature. (1,2,3,4)

1.2 Students will demonstrate the ability to solve hydrostatic problems involving manometers, hydrostatic forces on planar and curved surfaces, and hydraulics. (1,2,3,4)

1.3 Students will demonstrate the ability to solve fluid dynamic problems involving conservation of mass, momentum, and energy for viscous and inviscid flow. (1,2,3,4)

2.1 Students will demonstrate the understanding the naval related topics of ship stability, aerodynamics, turbomachinery and fluid transport. (1,2,3,4)

3.1 Students will demonstrate and understanding dimensional analysis used in fluids experiments. (1,2,3,4)

3.2 Students will demonstrate the ability to collect data and analysis experimental results. (4,5)

4.1 Students will demonstrate the ability to use differential and vector calculus to solve fluids problems. (1,2,3)

5.1 Students will demonstrate the ability to clearly present laboratory results and design projects in written and oral reports.(4,5,6)

6.1 Students will demonstrate the ability to contribute to laboratory and design teams. (4,5,6)

Date of Latest Revision: 4 NOV 2001

[1] Letters in parenthesis refer to the Program Objectives of the Mechanical Engineering Program.
[2] Numbers in parenthesis refer to the evaluation methods used to assess student performance.